L/Ka-band radar phenomenology: A first look at the SnowEx UAVSAR/GLISTIN data over Grand Mesa (CO)

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Overview of the talk

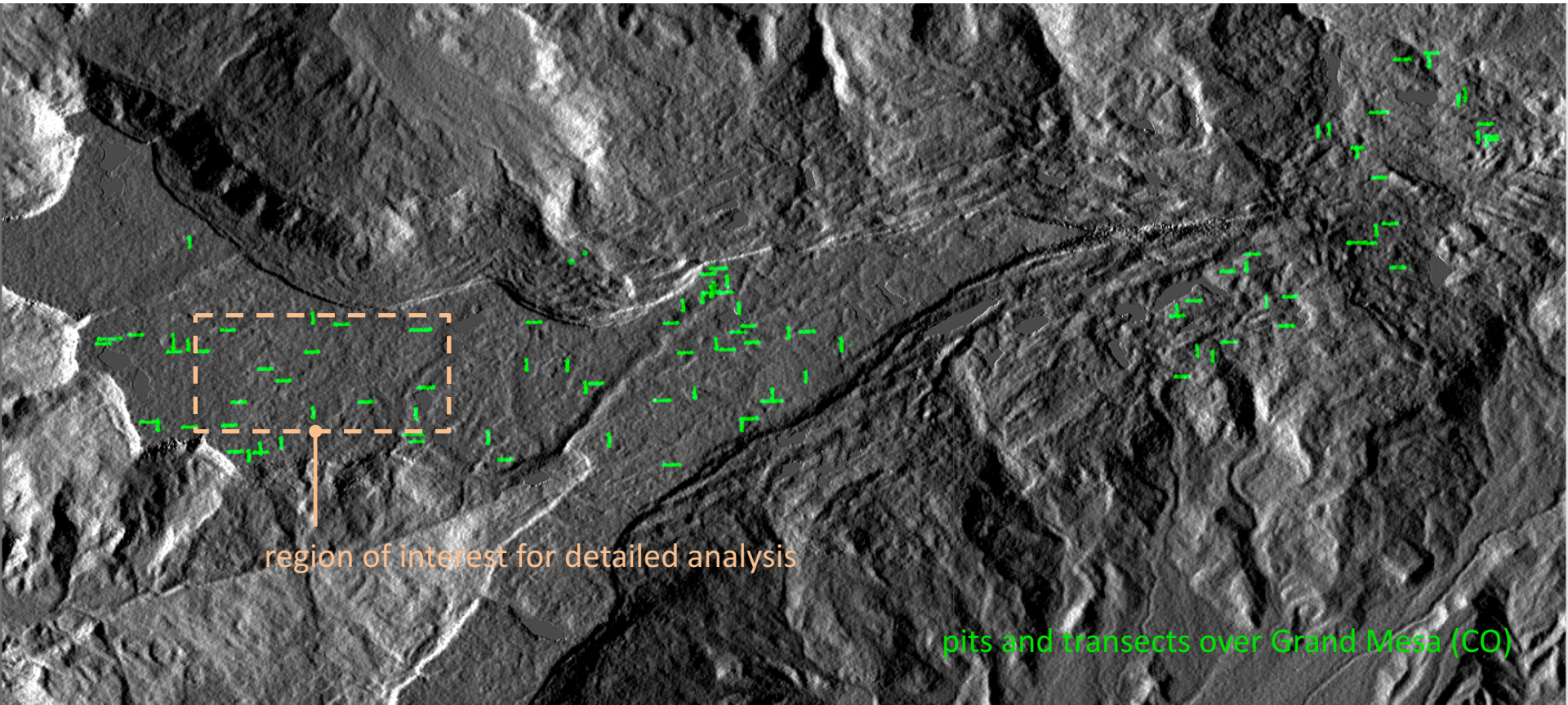
- SnowEx airborne SAR and field data in this study
- Approach to multi-SAR phenomenological analysis
- First results (QA/QC in progress)
  - Ka- and L-band backscatter
  - Effects of vegetation versus bare snow
  - Ka- and L-band InSAR coherence
  - UAVSAR InSAR phase versus field snow depth
- Closing remarks

Airborne SARs and field data in this study

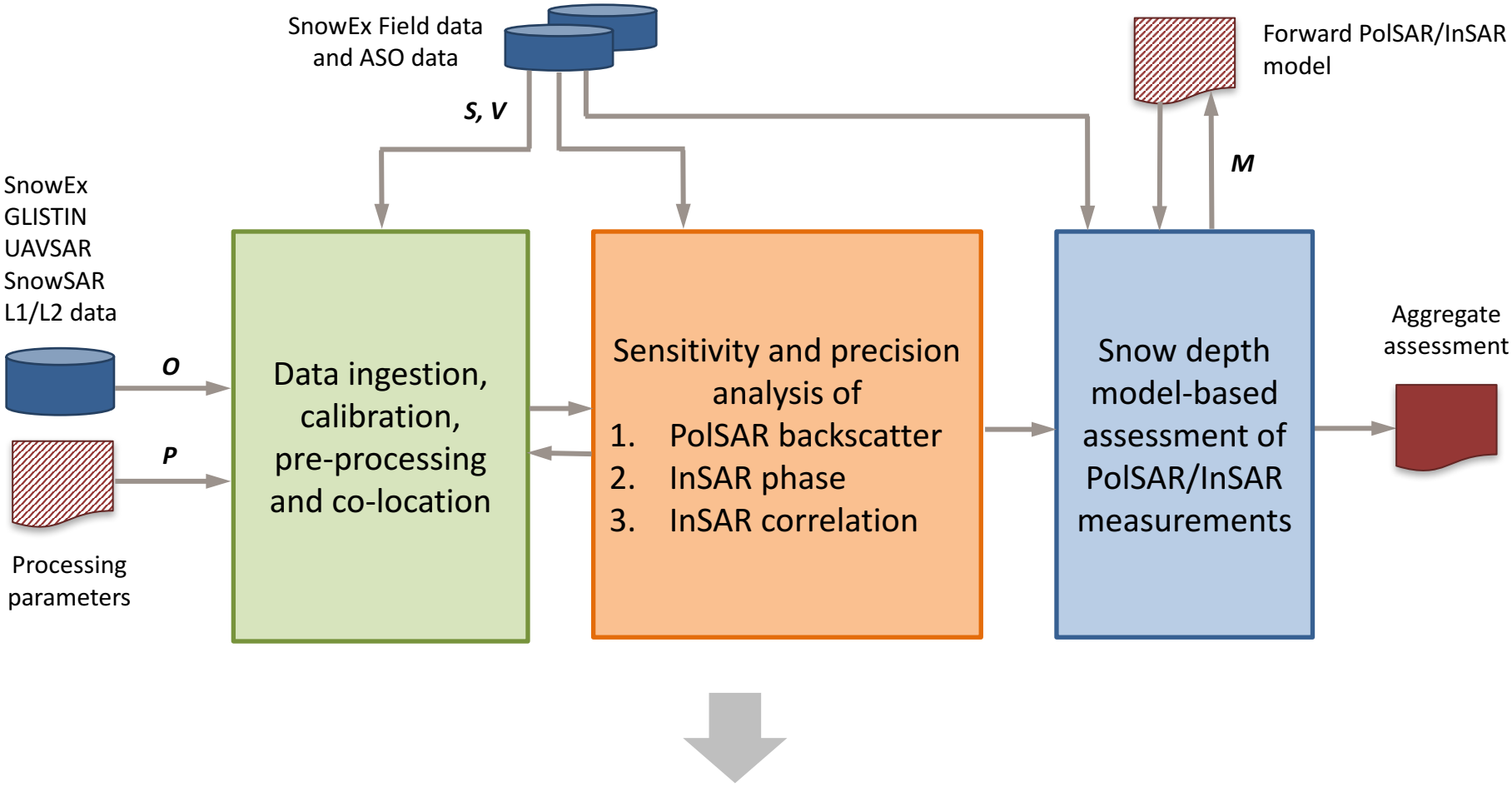
GLISTIN
Ka-band (35GHz)
Single-pass InSAR

SnowSAR
Ku/X-band (17.2/9.5GHz)
PolSAR

UAVSAR
L-band (1.24 GHz)
Repeat-pass PolSAR/InSAR

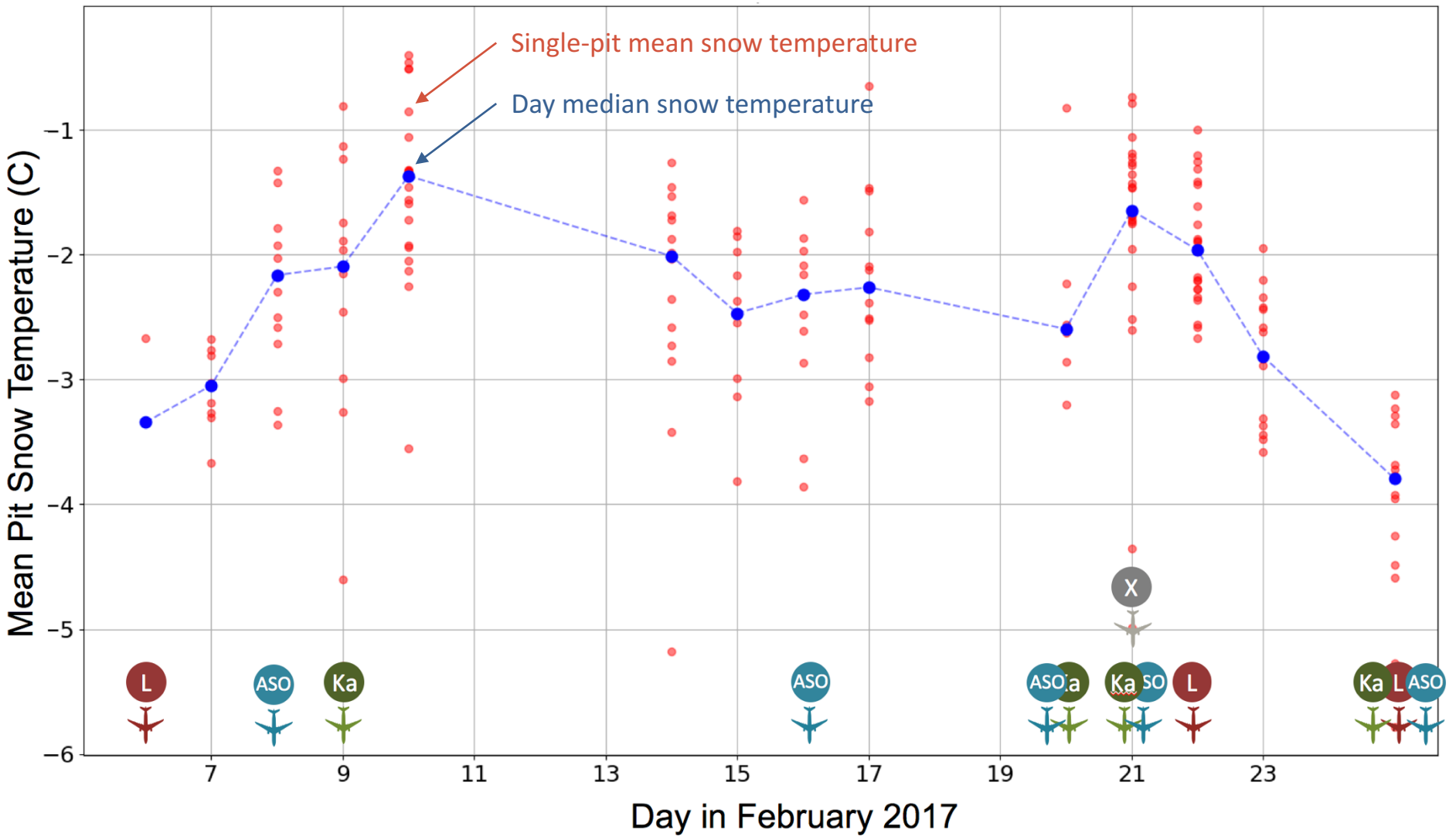


Approach to multi-SAR phenomenological analysis



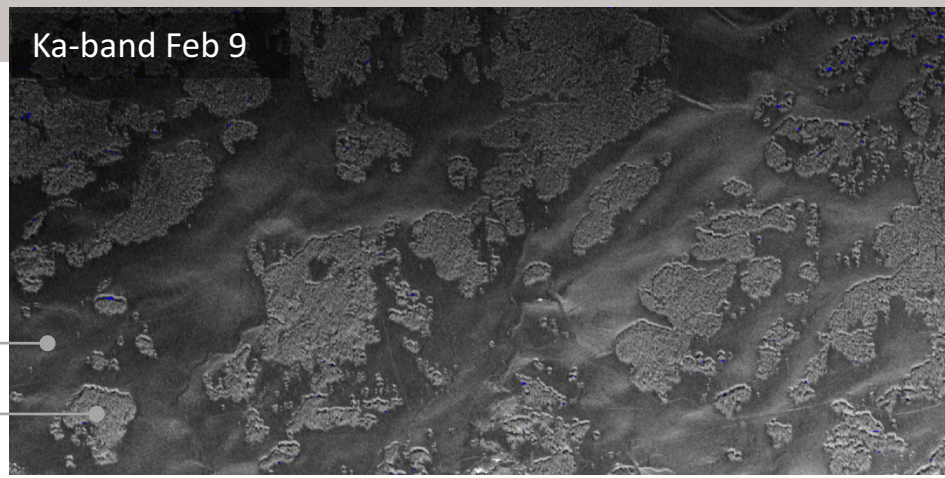
(1) Measurement for snow mission concept and (2) model-based retrieval algorithms

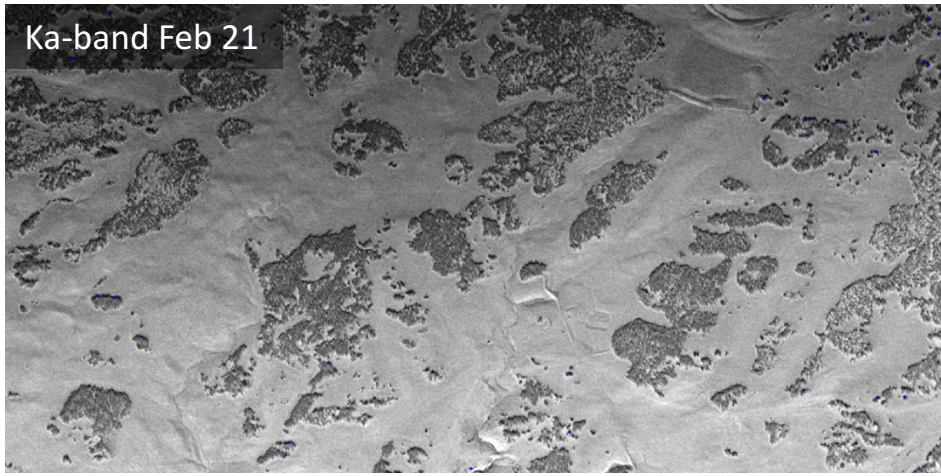
Snow Temperature during airborne flights

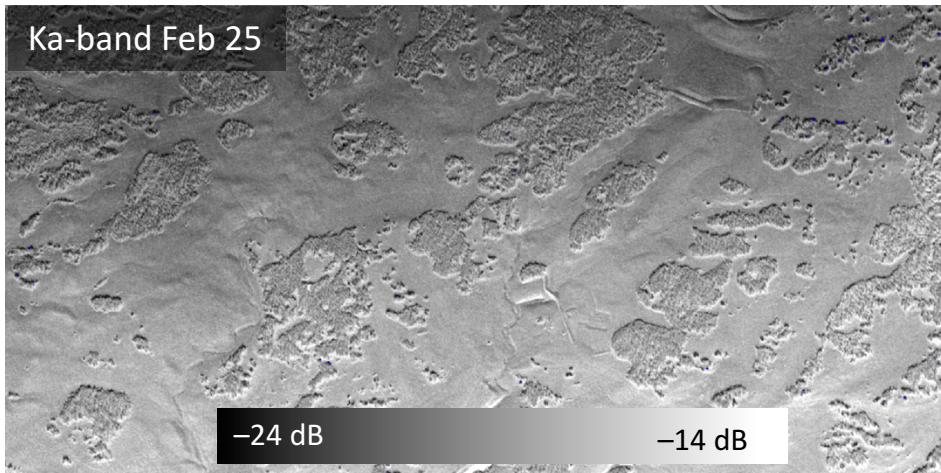


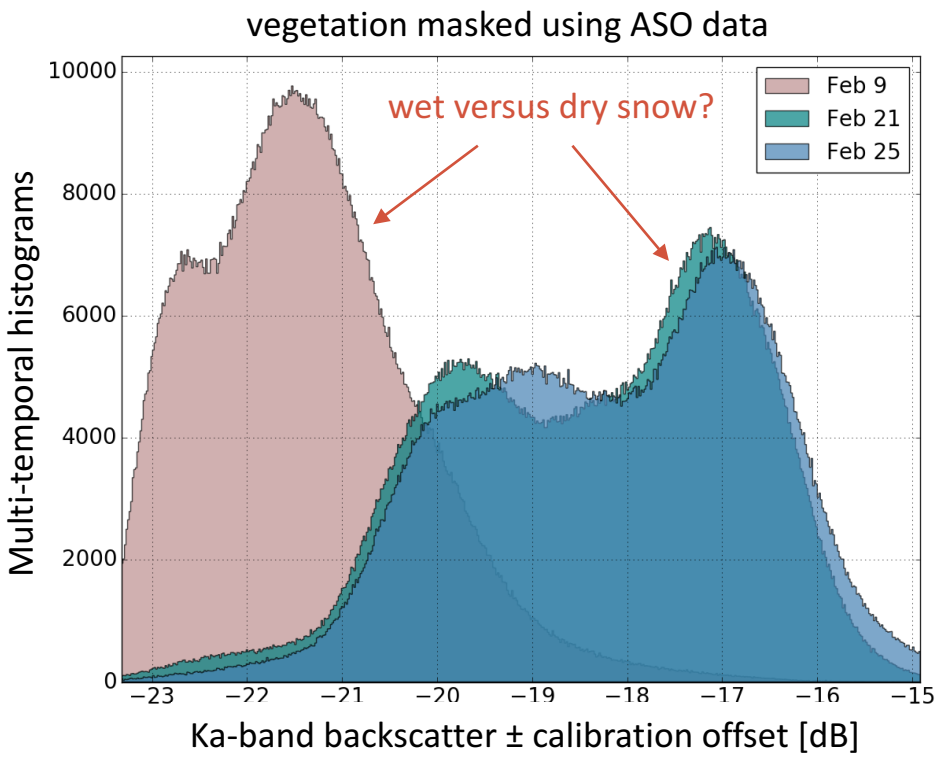
Ka-band backscatter in different dates

Preliminary data – QA/QC and calibration in progress

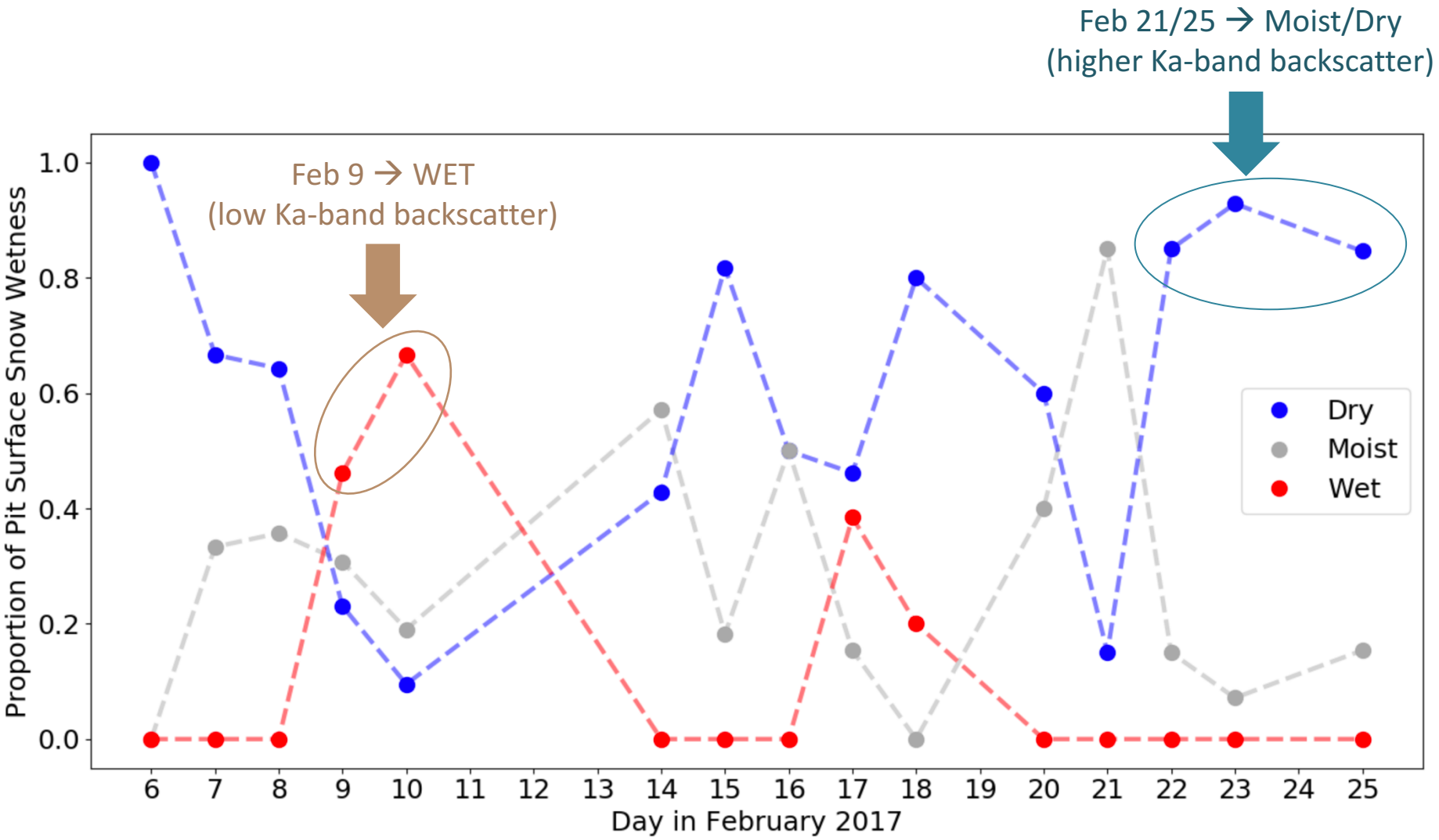








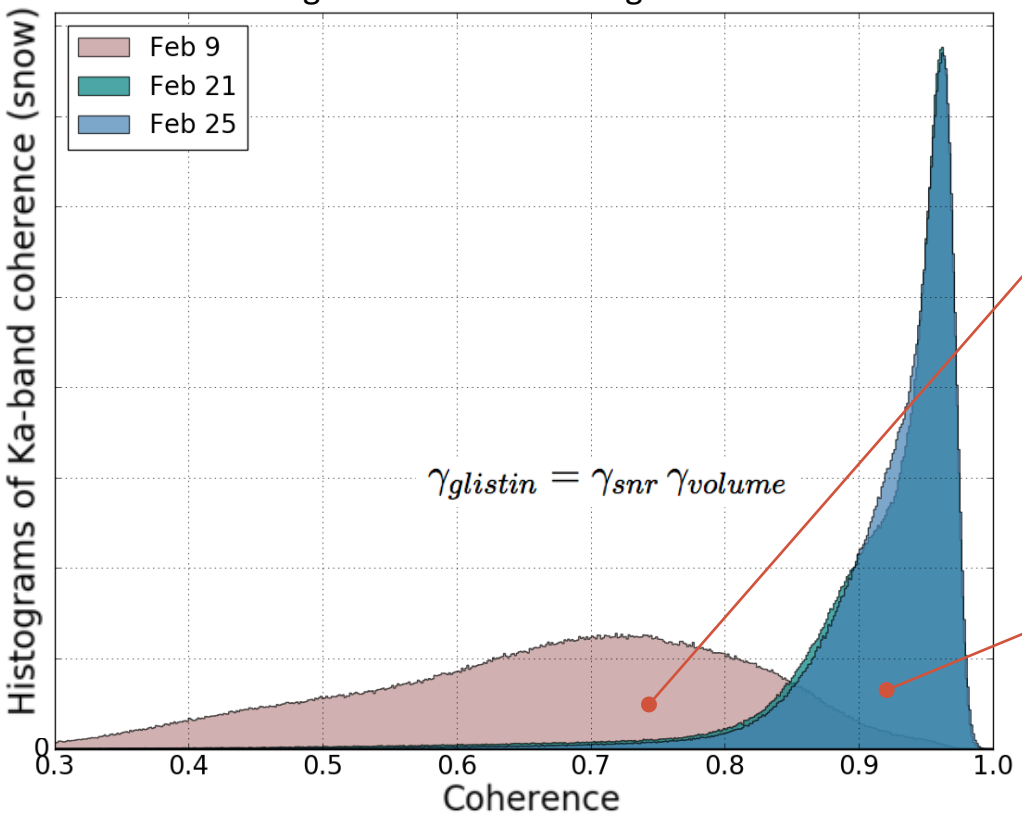
Dry/Wet surface snow from pit data

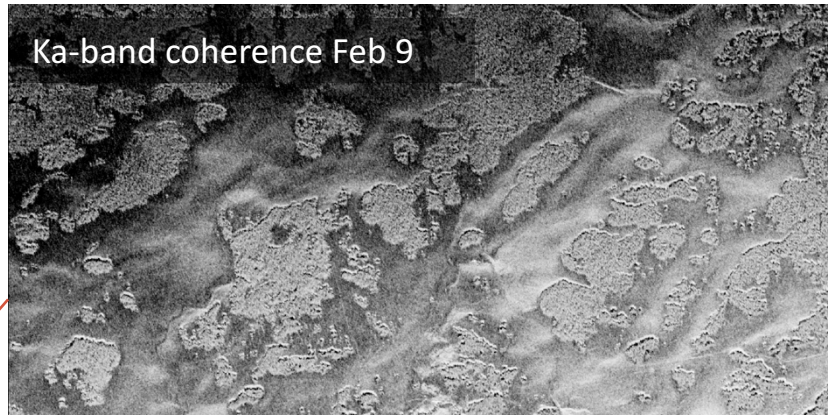


Effects of snow wetness on Ka-band InSAR coherence

Correlation and height precision estimated with 12 looks in 3x3 m^2
Low correlation on Feb 9 explained by low SNR rather than snow penetration effects

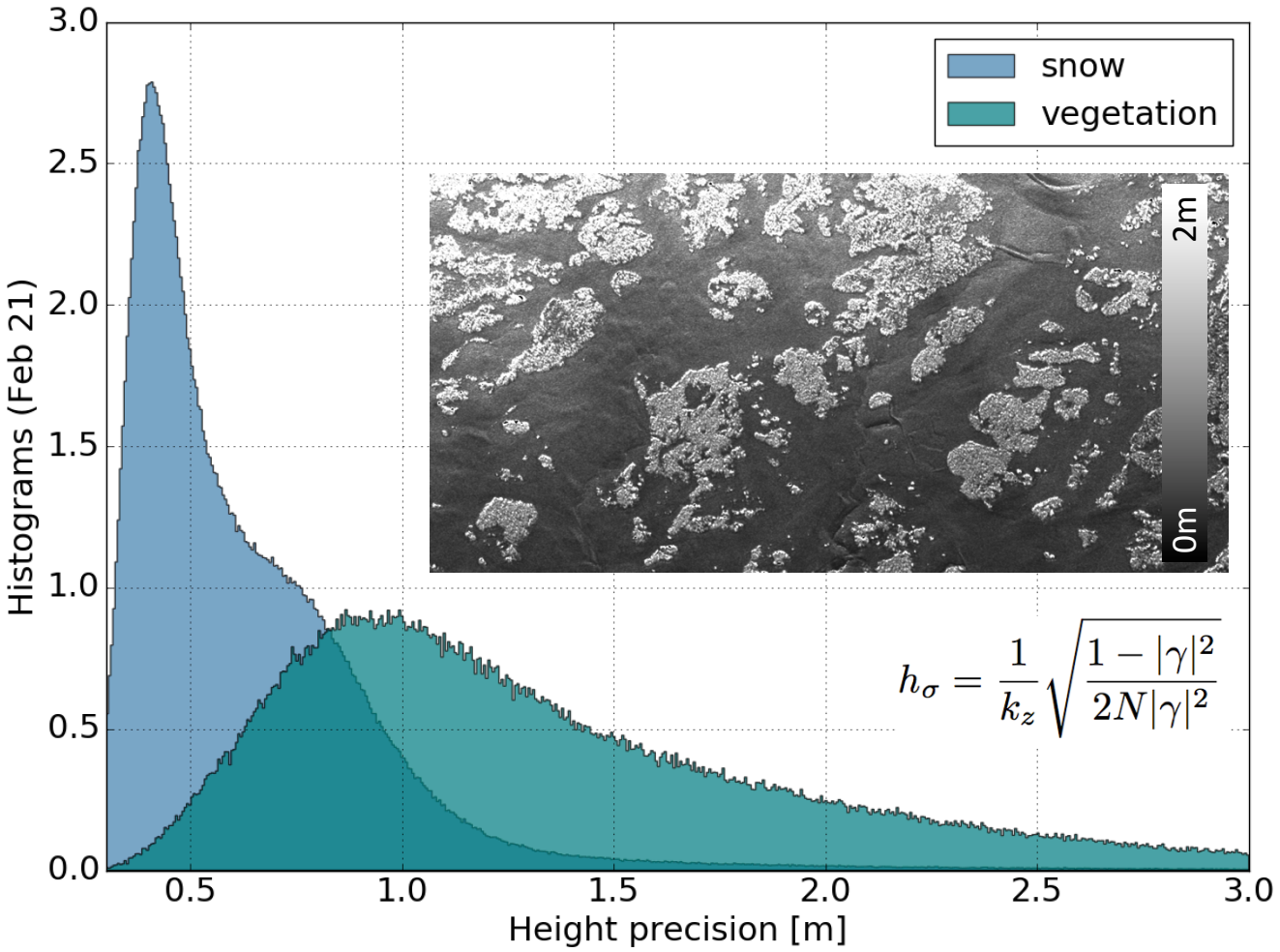
vegetation masked using ASO data





Vegetation and bare snow Ka-band height precision

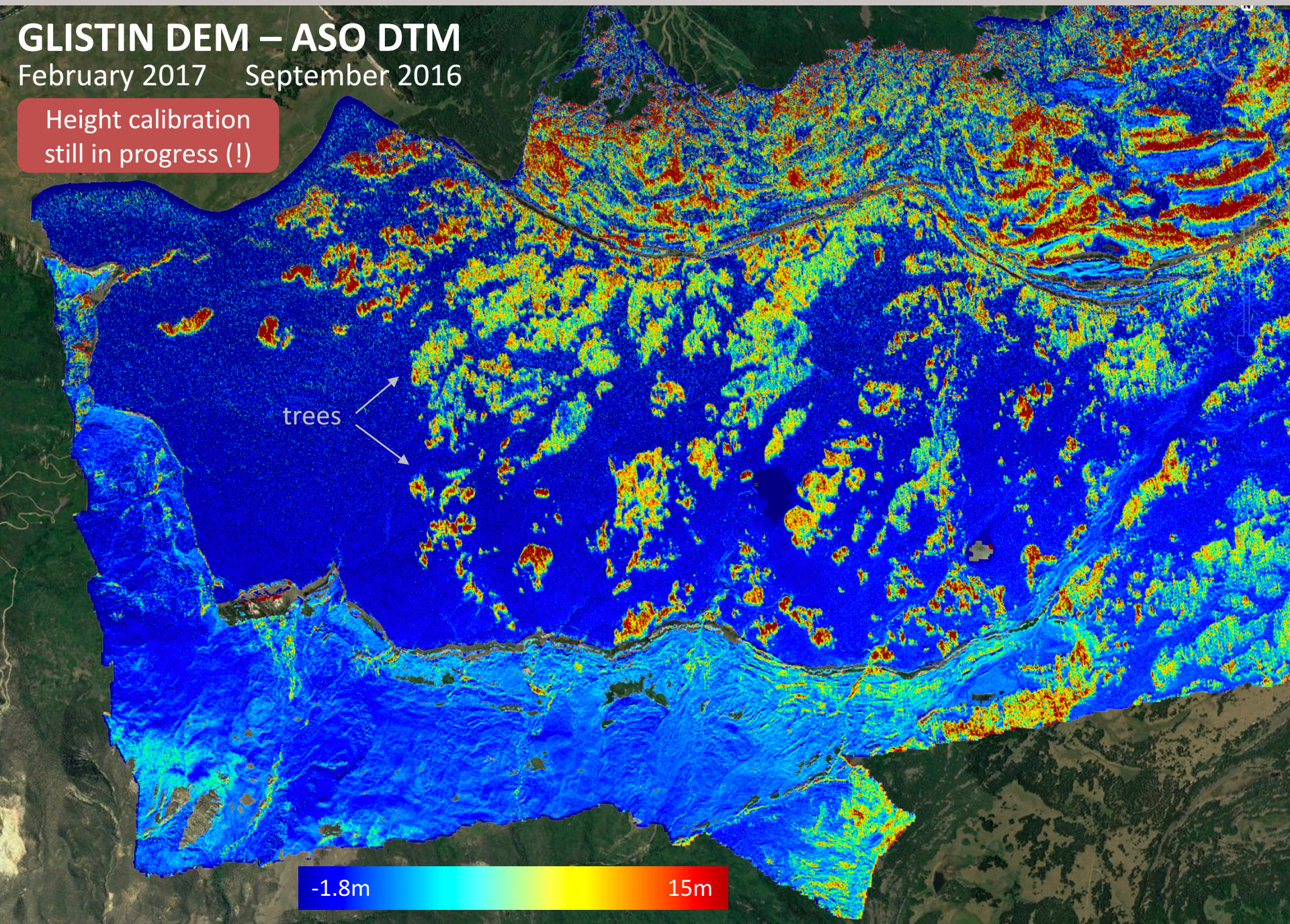
Vegetation mask generated using ASO lidar DEM and DTM difference
Height precision depends on land cover and can be controlled by baseline and number looks *N*



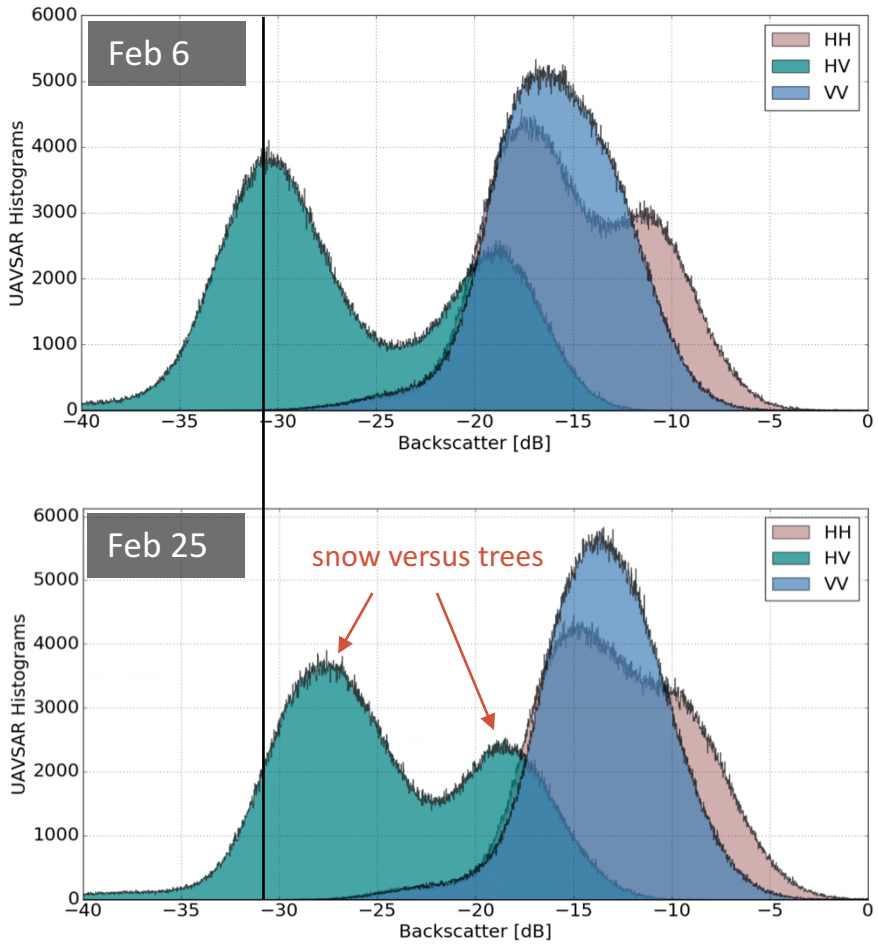
GLISTIN DEM – ASO DTM

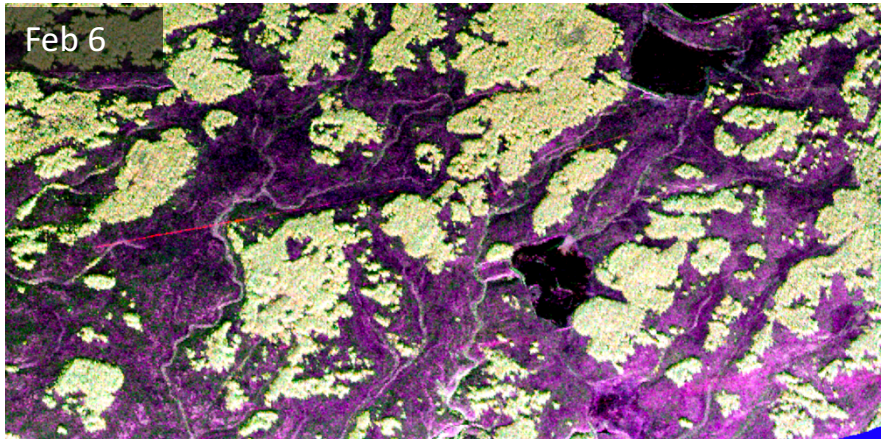
February 2017 September 2016

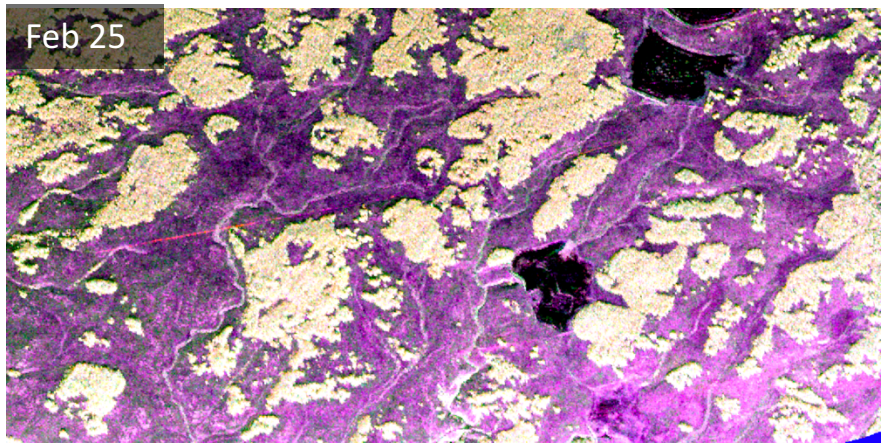
Height calibration still in progress (!)



L-band UAVSAR PolSAR backscatter

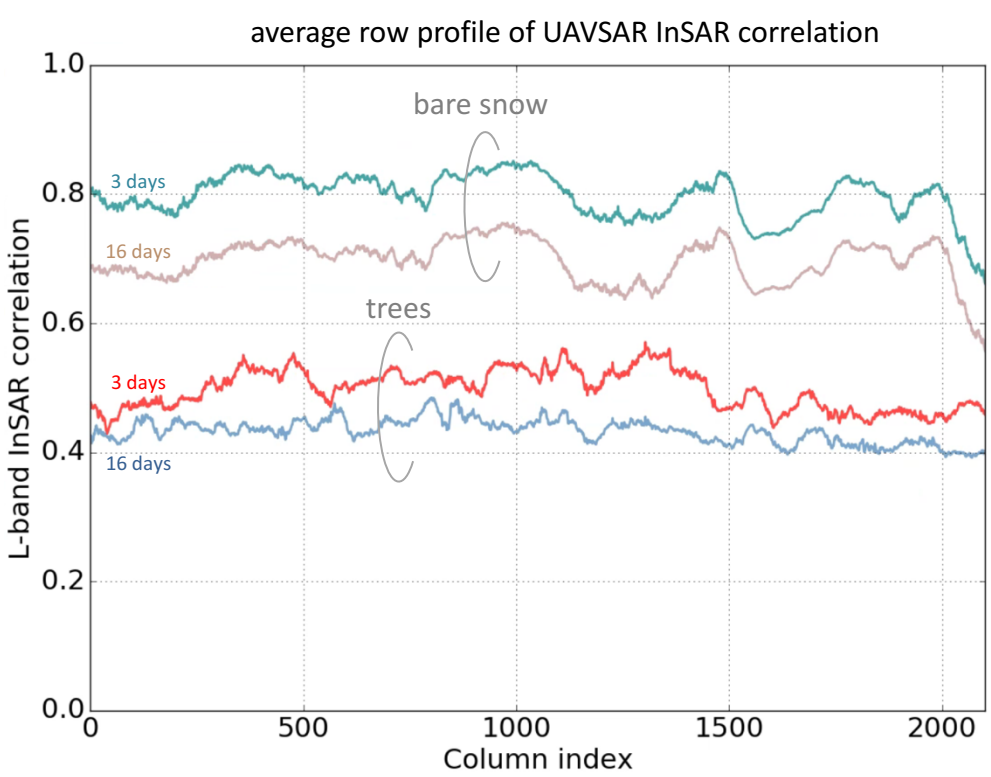


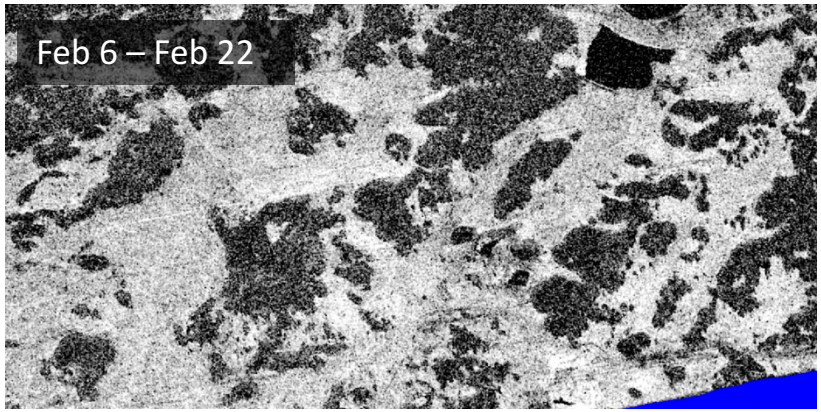


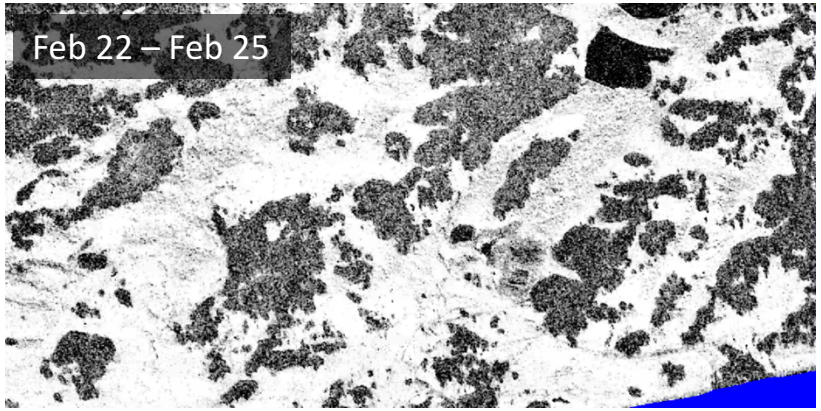


L-band UAVSAR InSAR coherence magnitude

16-day repeat interval shows relatively good coherence at L-band
Temporal decorrelation over trees larger than bare snow

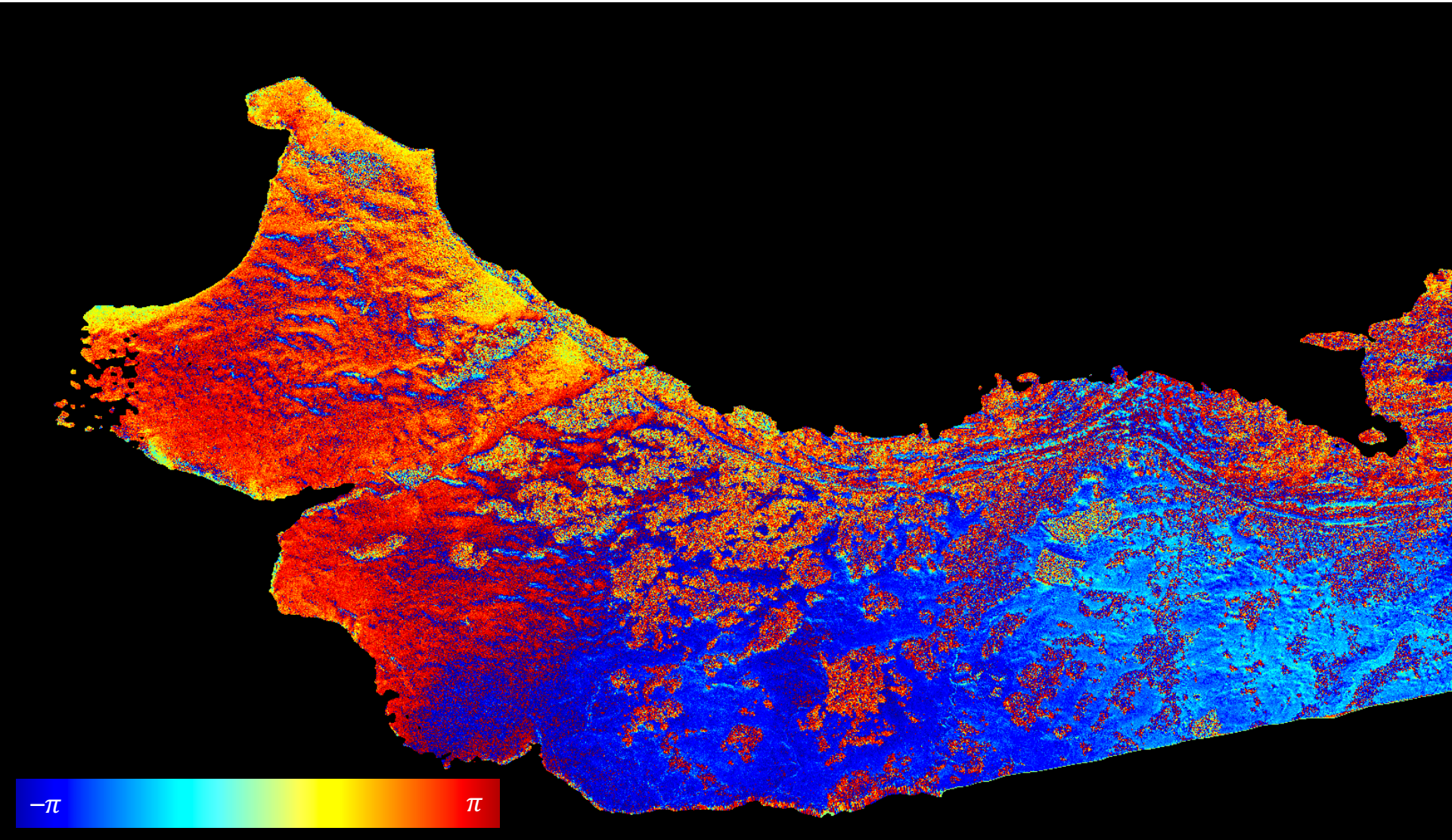






L-band UAVSAR InSAR phase Feb 6 – Feb 22

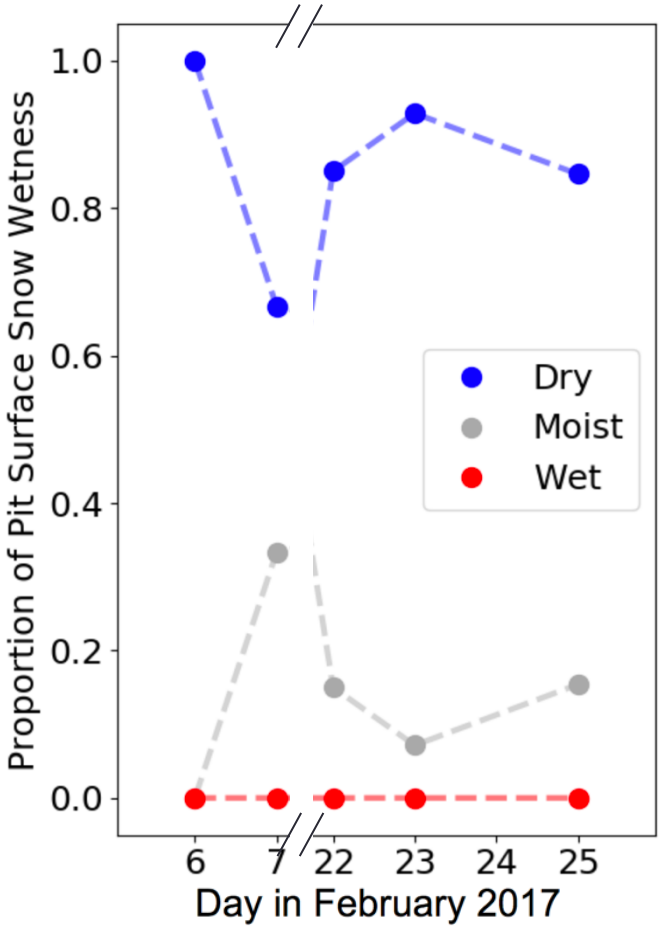
Preliminary data – QA/QC and calibration in progress



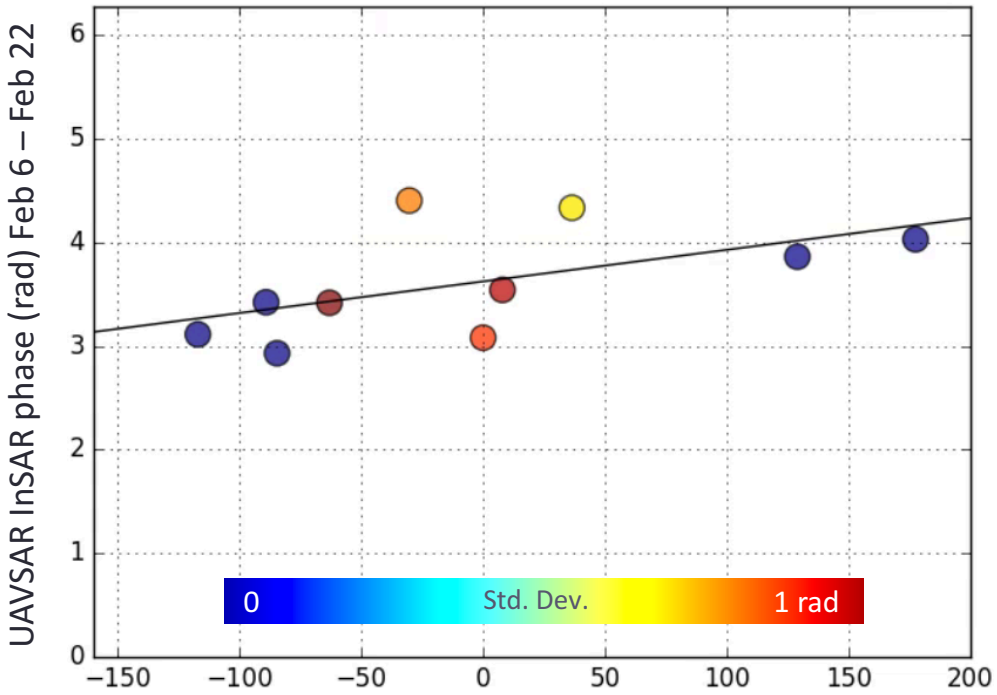
UAVSAR InSAR phase versus transect snow depth

Preliminary data – QA/QC in progress

Both Feb 6 and 22 have dry snow (pit data)



Linear correlation between InSAR phase and snow depth estimated from field transects



Closing remarks

1. Airborne SAR data overall appear well processed, but several expected calibration/processing issues need to be understood and fixed before using the data
2. Ka-band backscatter observed to change with snow wetness up to 5 dB on average; Ka-band InSAR SNR decorrelation may be > 0.5 depending on snow wetness
3. L-band coherence found > 0.7 even after 16 days on bare snow and > 0.4 on tress; L-band InSAR phase appears to be well correlated with field snow depth difference
4. All results are preliminary and need further analyses, in order to look at the SnowEx dataset as a whole, including airborne SAR, field data and models